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STRAY-FIELD MEASUREMENTS ON B2 DIPOLES, EPB QUADS, AND VERNIER MAGNETS

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This note contains information on the stray field at the ends of the magnets around the coils. The measurements were done in order to find a safe distance or the necessary shielding to operate magnetic field sensitive equipment like photomultipliers. Consequently, the measurements have only moderate accuracy (field ±5% ±5 G, field direction ±10°, positioning of probe ±0.25 in.). In all cases both the vertical and horizontal symmetry planes were mapped. If the field direction is not fixed by symmetry, direction and absolute value is given in the graphs. The following measurements were made:

EPB Quadrupole at 100 A dc excitation
No magnetic shielding (Fig. 1)

Vernier magnet at 100 A dc excitation
with and without shielding plate (Figs. 2 and 3)

B2 (main ring) dipole pulsed to 4800 A, 18 kG.
The field was measured at the flat top. Due to the asymmetric coil arrangement without shielding, the full vertical plane was measured (Fig. 4) and half the horizontal plane (Fig. 5). With the shielding plate the measurements were disturbed by remanent field effects in the plate and eddy currents in the plate, both having different time behavior and different space distributions from the field due to the primary excitation. The field map with the shielding plate (Fig. 6) has therefore only indicative value.

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Fig 1

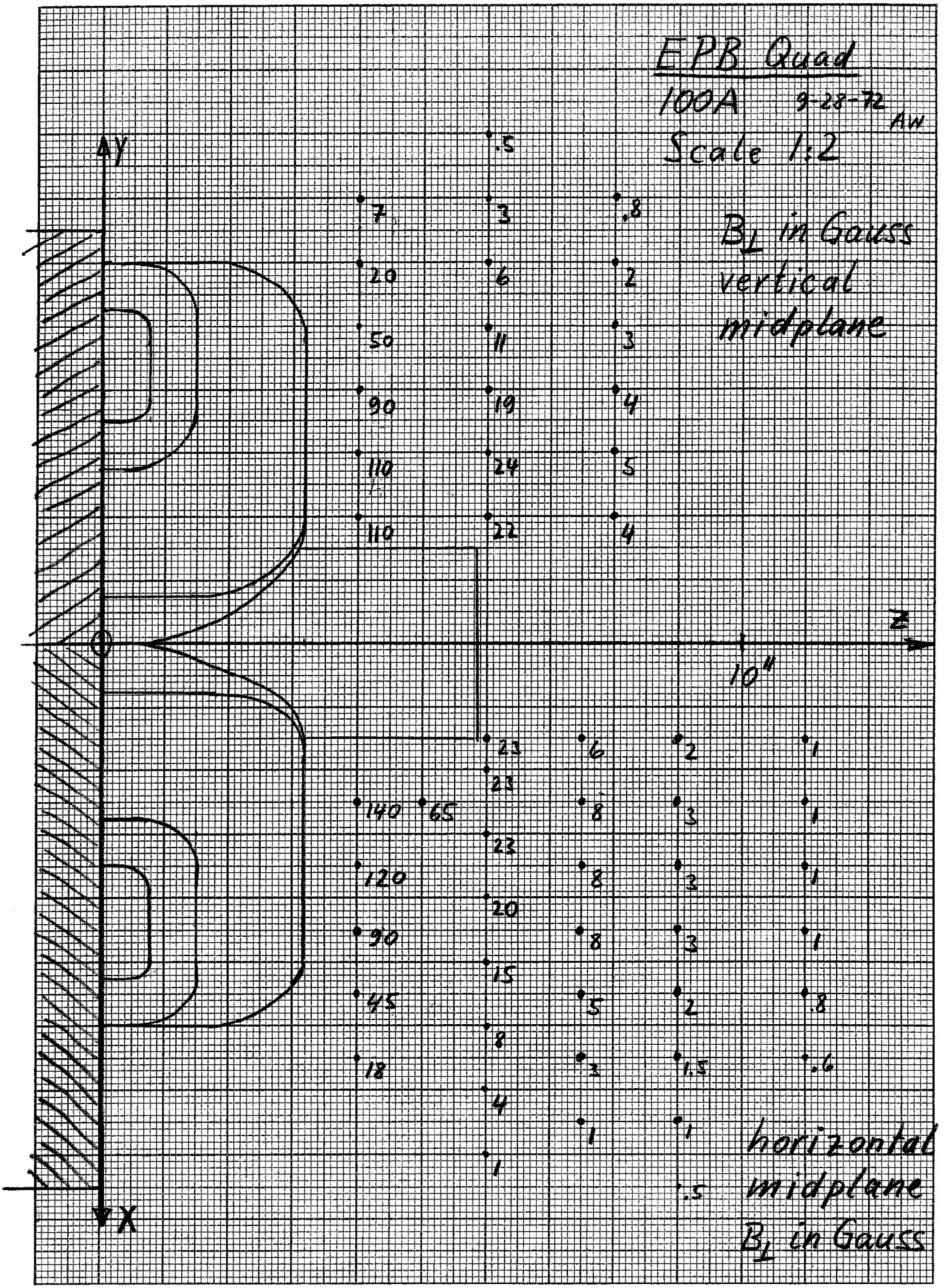

EPB Quad
100A 9-28-72 AW
Scale 1:2
B_L in Gauss
vertical
midplane
Y
X
Z
10"
.5
3
6
11
19
24
22
7
20
50
90
110
110
.8
2
3
4
5
4
23
23
22
20
15
8
4
1
140
120
90
45
18
65
6
8
8
8
5
2
1
2
3
3
3
2
1.5
1
.5
1
1
1
1
.8
.6
horizontal
midplane
B_L in Gauss

Fig 2

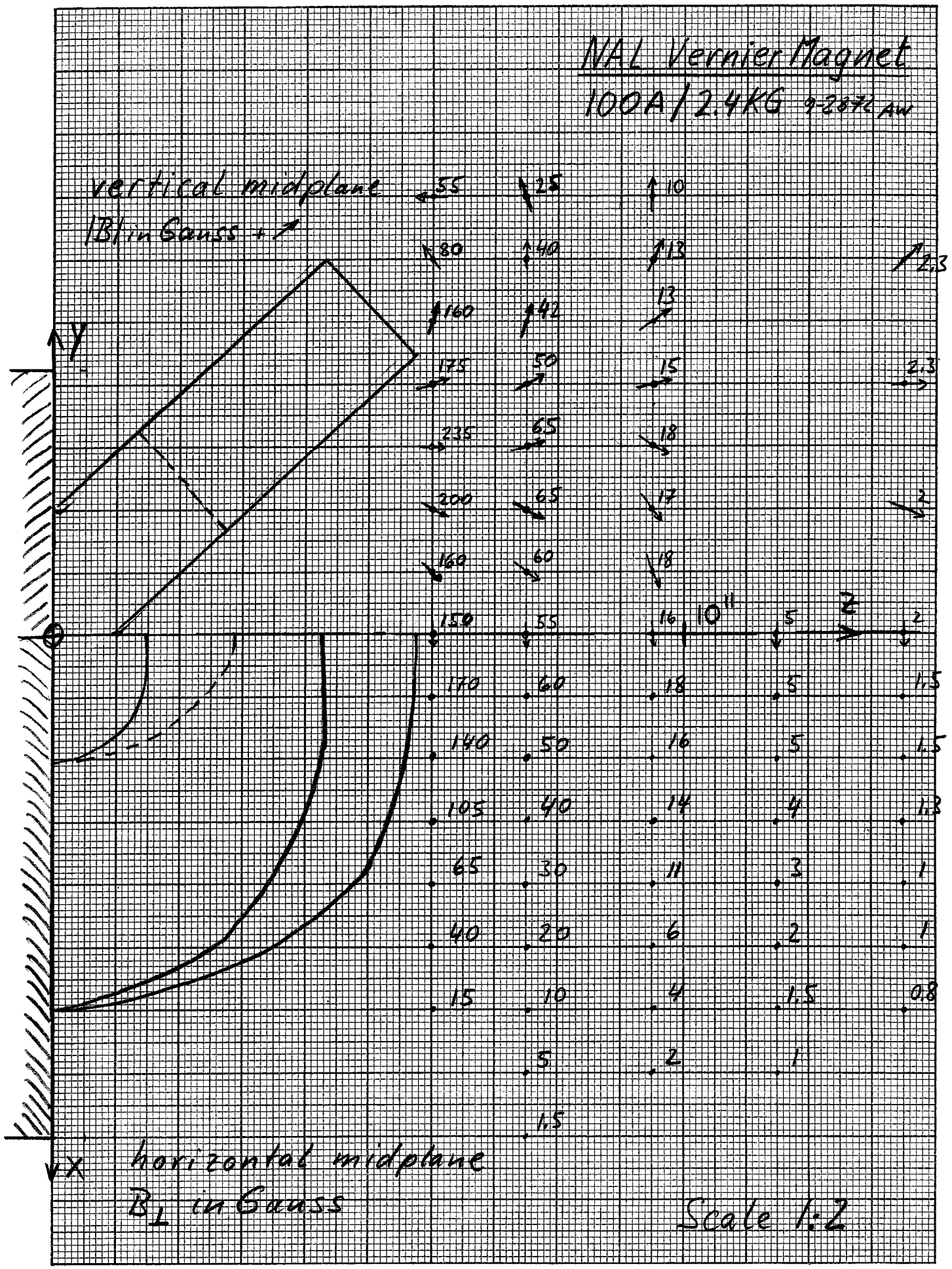

NAL Vernier Magnet
100A / 2.4KG 9-28-72 AW
vertical midplane
|B| in Gauss
Y
X
horizontal midplane
B_1 in Gauss
Z
10^{11}
Scale 1:2

Fig 3

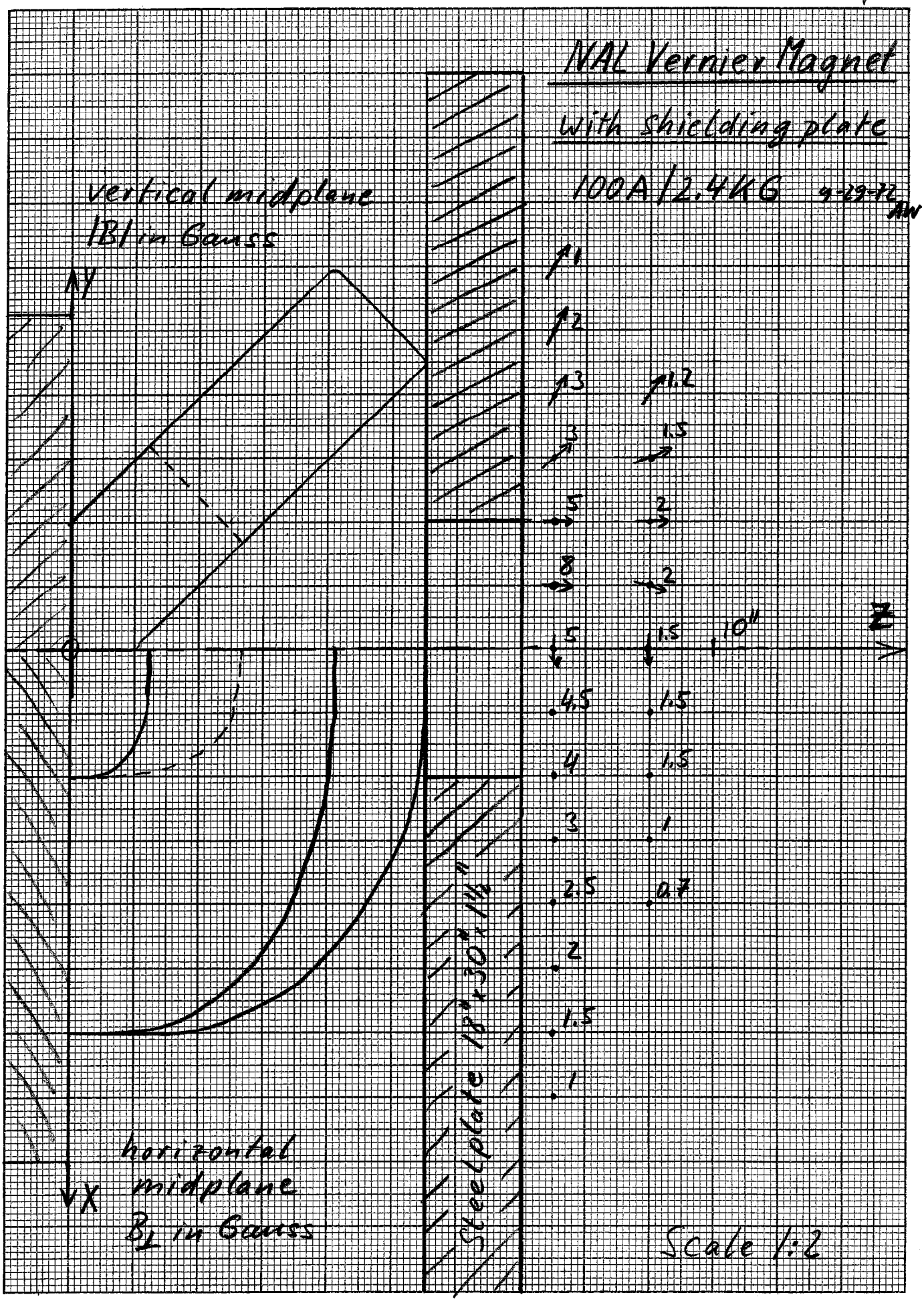

NAL Vernier Magnet
with shielding plate
100A/2.4KG 9-29-72 AW
vertical midplane
|B| in Gauss
Y
X
Z
horizontal
midplane
$B_\perp$ in Gauss
Steelplate 18" x 30" x 1½"
1
2
3
1.2
3
1.5
5
2
8
2
5
1.5
10"
4.5
1.5
4
1.5
3
1
2.5
0.7
2
1.5
1
Scale 1:2

Fig 4

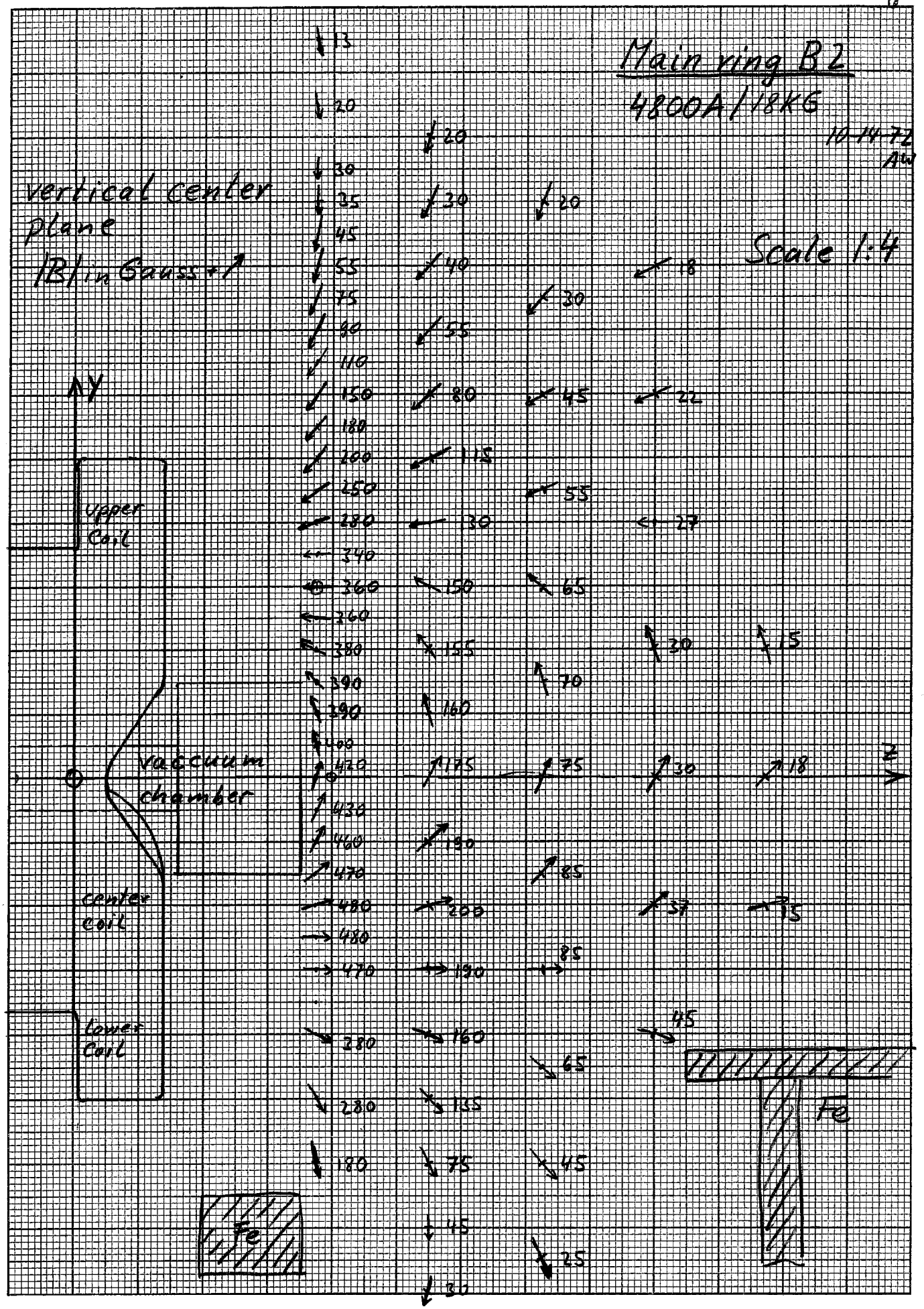

Main ring B2
4800A/18KG
10-14-72
AW
Scale 1:4
vertical center plane
|B| in Gauss
Y
Z
upper Coil
vacuum chamber
center coil
lower Coil
Fe
Fe
13
20
30
35
45
55
75
90
110
150
180
200
250
280
340
360
360
380
390
390
420
430
460
470
480
480
470
280
280
180
45
30
20
30
40
55
80
115
130
150
155
160
175
190
200
190
160
135
75
45
30
20
18
30
45
55
65
70
75
85
85
65
45
25
22
27
30
30
37
45
15
18
15

Fig 5

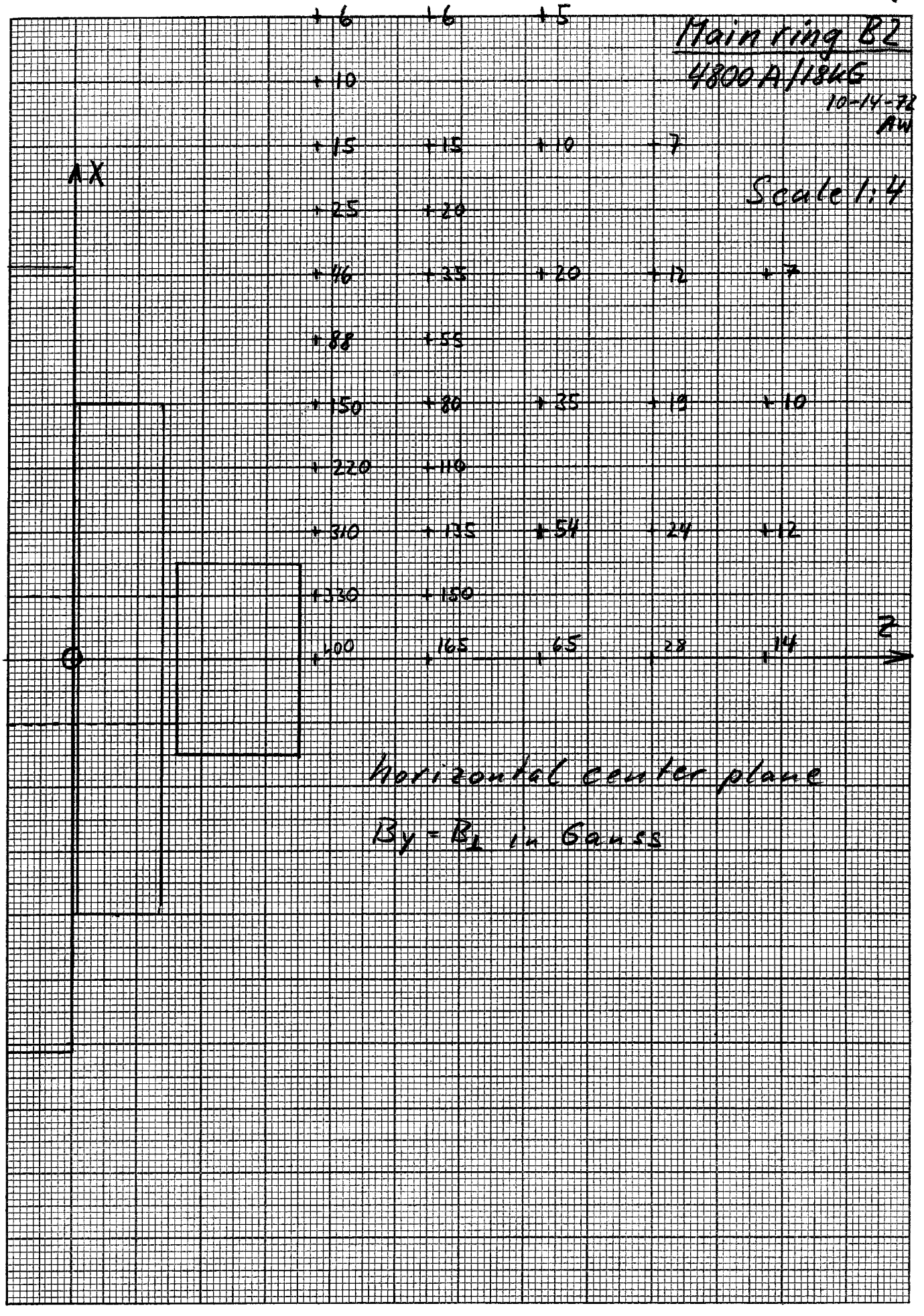
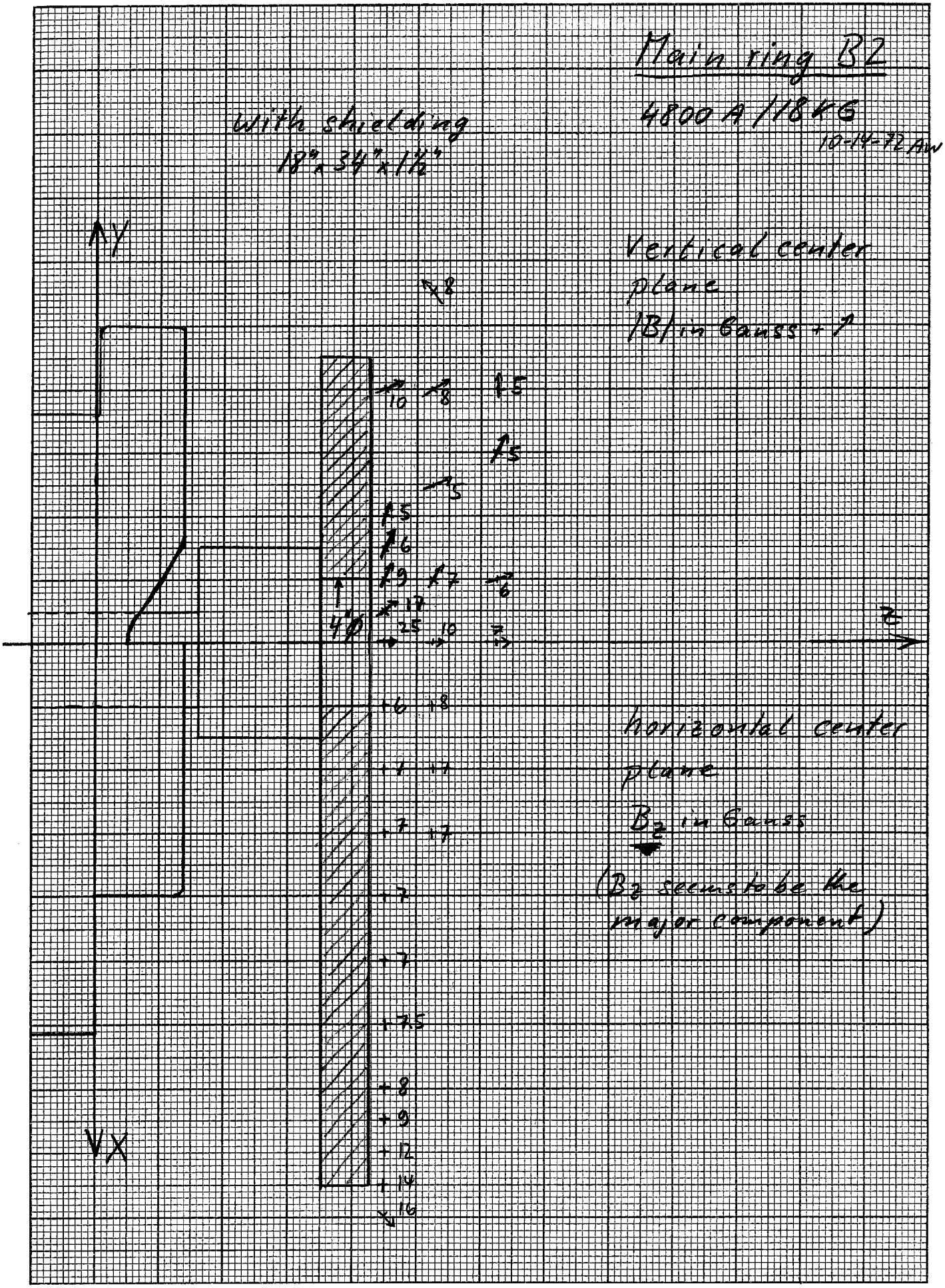

Main ring B2
4800 A/184 G
10-14-72
AW
Scale 1:4
X
Z
+6 +6 +5
+10
+15 +15 +10 +7
+25 +20
+46 +35 +20 +12 +7
+88 +55
+150 +80 +35 +19 +10
+220 +110
+310 +135 +54 +24 +12
+330 +150
+400 +165 +65 +28 +14
Horizontal center plane
By = B1 in Gauss

Fig 6


Main ring B2
4800 A / 18 KG
10-14-72 AW
with shielding
18" x 34" x 1½"
Y
X
Z
Vertical center plane
|B| in Gauss + ↑
horizontal center plane
B_z in Gauss
(B_z seems to be the major component)
4"Ø
8
10
8
5
5
5
5
6
9
7
6
17
25
10
7
+6
+8
+7
+7
+7
+7
+7
+7.5
+8
+9
+12
+14
16